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RESEARCH HIGHLIGHTS

1993 - 1994

U.S. SUGARCANE FIELD LABORATORY

Sugarcane Research Unit

Agricultural Research Service

United States Department of Agriculture

Houma, Louisiana

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MISSION AND STAFF

The mission of the Sugarcane Research Unit is to conduct basic and applied research to increase sugarcane production efficiency while minimizing the impact of the crop's culture on water quality and other ecosystems to include wet land preservation in the high rainfall, mineral soil, subtropical climate of the lower Mississippi Delta. Further, this research will have general applicability to the research programs of the other sugarcane producing states. The Unit will approach this mission by developing improved sugarcane germplasm and cultivars through conventional breeding and molecular approaches that combine traits to overcome productivity barriers with genetic resistance to disease and insect pests, cold tolerance, and ratoon longevity. These new biotechnology tools will be applied to our specific climatic and edaphic condition facilitating production efficiency. An equally important aspect is to develop and integrate effective management strategies which complement the cultivars developed, hasten maturation and sugar storage, and combat a constantly evolving group of disease, insect, and weed pests - pests which often exhibit genetic diversity within their populations. Traditional tactics of integrated pest management such as biological control and host plant resistance involving natural predators/plant pathogens, high unit activity pesticides, and cultural practices developed through interdisciplinary research will be designed to reduce pesticide loading per unit area and keep pest populations below Unit-identified economic damage threshold levels.

The productivity of the Research Unit is greatly enhanced by the support of the American Sugar Cane League and the cooperation of the Louisiana Agricultural Experiment Station. The research reported here is a progress report of recent research.* The current USDA-ARS professional staff and the authors of this report are as follows:

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* The data and interpretations in this report may be modified by additional experimentation; therefore, the report should not be published in part or whole without prior approval of the Sugarcane Research Unit, USDA-ARS, Houma, Louisiana and the cooperation agencies and organizations concerned.

BREEDING

Basic Crosses. Sugarcane cultivars are derived from crosses of various related species, such as *Saccharum officinarum*, *S. spontaneum*, and *S. robustum*. Most of today's cultivars are derived from only a few clones of these species. While there remains considerable genetic variability, a limited genetic base could predispose sugarcane cultivars to suboptimum yield and attack by various pests. A basic breeding program was established at Houma in 1972 with the objective of broadening the genetic base of our cultivars by crossing adapted Louisiana sugarcane with exotic germplasm. Traits contributed from the exotic relatives include resistance to diseases (sugarcane mosaic virus, smut, leaf scald, and ratoon stunting disease) and insects (stalk borer), leaf and stalk cold tolerance, and increased yield through better ratooning ability and better adaptation to mechanical harvesting. The hybrid plants are field selected and crossed again with elite clones. Repeated crossing and field selection leads to the development of hybrid plants with enhanced genetic diversity. But the breeding process is very time consuming. Final selection requires a minimum of 13 years from the date of the initial cross to identification of hybrid plants suitable for release to growers.

Nearly 4,600 crosses were made yielding 7.3 million seeds from 1972 through 1994. Each year, an average of 198 crosses is made between 56 unique parents yielding about 320,000 seeds. We continually strive to improve our crossing effectiveness and set new records: 115 parents were crossed in 1994 and 1,405 seeds per tassel were produced in 1992 (average is 569).

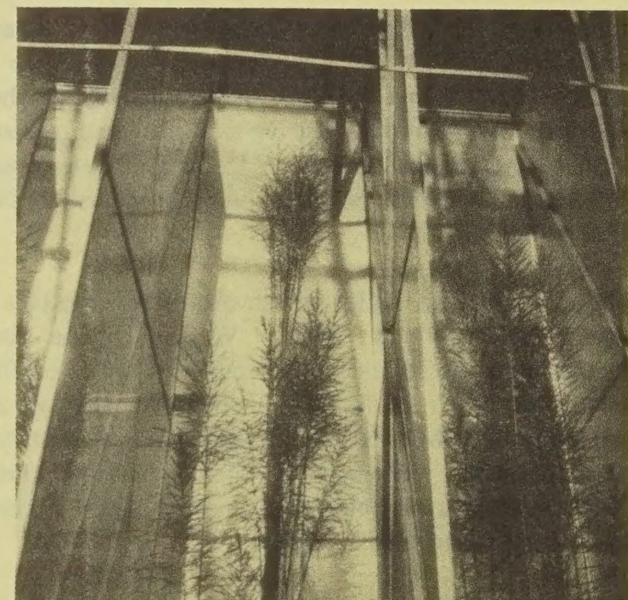
A living collection of native North American relatives of sugarcane was begun in 1992. We now have about 110 populations of eight species and cultivars collected from the southeast USA. Crosses were made between sugarcane and this germplasm for the first time in 1993. Further study is needed to determine the breeding value of these hybrids. Molecular approaches are being developed to identify hybrids between sugarcane and exotic species.

There were 139 candidate cultivars selected from basic crosses, four of which were released to the industry: TUCCP 77-42 in 1989 (Argentina); LHo 83-153 in 1991; and HoCP 85-845 and LCP 85-384 in 1993. The last three cultivars were derived from the *S. spontaneum* clone US 56-15-8. Also, 402 hybrid clones were assigned US numbers from field selection, for further crossing with cultivars. **(D.M. Burner and B.L. Legendre)**

Summary of basic breeding program at Houma, LA.

Breeding year	Seedlings set to field	Established in 1st line trials	Established in 2nd line trials	Superior clones receiving permanent assignments US	CP[1]
1972-76	138,216	5,302	863	118	22
1977-81	105,429	7,452	1,027	133	45
1982-86	126,131	8,137	1,283	108	34
1987	21,116	1,527	106	12	2
1988	22,425	659	78	14	7
1989	21,065	1,876	193	17	29
1990	16,909	912	97	--[2]	--
1991	14,201	577	113	--	--
1992	18,445	893	---	--	--
1993	8,134	---	---	--	--
1994	13,500[3]	---	---	--	--
Total	505,571	27,335	3,760	402	139

[1] Includes Ho and HoCP assignments.
[2] Data not yet available.
[3] Estimated.



Tassels in crossing cubicles.

Seedling and Clonal Selection. Historically, all true seed for the commercial breeding and selection program at Houma, LA have come from crosses made at Canal Point, FL and, prior to 1972, all seed for the basic breeding and selection program also came from crosses made from Canal Point. However, since 1972, the basic crossing program for Louisiana has been conducted at Houma.

The progression of a cross through the selection program from seed to assignment of permanent numbers is described by Breaux (1973) and Dunckelman and Legendre (1982). In the past, preliminary screening of seedlings for resistance to mosaic virus was conducted in the greenhouse; however, since 1979 this practice has been abandoned in favor of careful parent selection. Selection for mosaic resistant types begins in the first-ratoon crop of the single-stool nursery and continues throughout the 13-year selection process. Other selection criteria used in the single-stool nursery include: stalk number, diameter, height, density, erectness, the absence of pith or a hole, and refractometer Brix. Further, some single stools are rejected for extreme growth cracking along the stalk, germinated or protruding buds, excessive adventitious roots, extreme sensitivity to herbicides and extreme reaction to the sugarcane borer. Evaluation is continued in single-row, 1.8 m (6 ft) and 5.2 m (16 ft) clonal plots (first- and second-line trials, respectively). Essentially the same selection criteria are used in both clonal plots as was used in the single-stool nurseries with the exception that laboratory Brix and sucrose are obtained on all selected clones in both the plant- and first-ratoon crops of the second-line trials. The second-line trials give more objective yield estimates including stalk population and estimated theoretical recoverable sugar per ton of cane (TRS).

Clones with commercial potential in the first-ratoon crop of the second-line trials are assigned permanent HoCP or Ho (Houma/Canal Point or Ho) numbers and replanted in replicated nurseries for further evaluation. Currently, the Ho designation is being used for commercial assignments made from the basic breeding program at Houma while the HoCP designation is for commercial assignments where the seed are produced at Canal Point but the selections are made at Houma. Early generation hybrids from new basic breeding lines not assigned Ho numbers are assigned US (United States) breeding numbers and used in the basic breeding program as nonrecurrent parents for another cycle of backcrossing with selected interspecific hybrids used as recurrent parents.

A total of 5,354 clones were selected and replanted from single stool nurseries in 1993 while 77 superior clones were assigned permanent cultivar numbers (93 Series) and replanted. Thirty-one cultivars (92 Series) were planted to two off-station nurseries while 75 cultivars (90-92 Series) were planted to replicated infield tests. Twenty-nine cultivars (89-91 Series) were harvested from 3 off-station nurseries and 37 cultivars (87-91 Series) were harvested from 7 infield tests in either the plant and/or 2 ratoon crops. Selection criteria now includes absence of leaf scald symptoms, a potentially serious new disease discovered in 1992. Nineteen cultivars (90-91 Series) were introduced to 10 outfield locations while yield data (31 tests) were obtained for 6 cultivars (86-88 Series) from 13 locations. Two cultivars, HoCP 85-845 and LCP 85-384, were released for commercial planting with both having superior yield potential, especially in the ratoon crops.

Significant gains (44%) in sucrose content of sugarcane have been achieved at Houma through 5 cycles of recurrent selection over the past 58 years. Concurrently, sugar recoveries at the mills have increased dramatically and now exceed 10% per gross ton of cane in a 7 to 9 month growing season. The sugarcane breeding program selects new cultivars from among approximately 100,000 new entries each year for at least 24 characteristics, including maturity, sucrose content, purity,

harvestability, fiber content, cane tonnage, and resistance to selected disease and insect pests. One cultivar, LCP 86-454, was released for commercial planting in 1994 after 13 years of testing with superior sucrose content, early maturity, harvestibility, and resistance to the sugarcane borer, a major insect pest. **(B.L. Legendre)**

Secondary Selection. The first stage of the breeding program in which plots are mechanically harvested is known as the infield stage (Stage V). This is also the first stage in which cultivars from the state breeding program (L's, LCP's, and LHo's) are tested with HoCP and Ho cultivars. Some varietal traits studied in the infield are sucrose and purity content, estimated yield of theoretical recoverable sugar per ton, stalk number, stalk weight, yield of tons cane per acre and estimated yield of sugar per acre, fiber percent cane, and harvestability.

Plots in infield tests are 16 ft long by 3 rows wide (18 ft). Each test is made up of two replications. For comparison, three commercial cultivars (CP 65-357, CP 70-321, and/or CP 74-383, CP 72-370, LCP 82-89) are included in each replication as controls. Plots are cut with a single-row, whole stalk harvester and then weighed with a tractor-mounted hydraulic weighing system. To be considered for further testing, experimental candidate cultivars must equal or exceed the control cultivars in yield of sugar per unit area, possess an acceptable level of disease and insect resistance, show adaptability to mechanical harvesting, and have good milling qualities (balance of fiber and juice extraction).

Experimental candidate cultivars from the 1989 through 1992 HoCP and Ho series and 1989 through 1991 L series were harvested from infield tests in 1994. A brief discussion of each series follows.

1989 Series. Four candidate cultivars from the 1989 series (2 HoCP's, 1 Ho, and 1 L) were sampled from second-ratoon tests at Ardoyne Farm and St. Gabriel Research Station in 1994. All four of these candidate cultivars were equal to the commercial cultivars in yield of sugar per acre.

1990 Series. Five experimental candidate cultivars from the 1990 HoCP and Ho series were harvested from first-ratoon and plant-cane tests at Ardoyne Farm and a first-ratoon test at the St. Gabriel Research Station in 1994. In this series, HoCP 90-957 was consistently equal to or higher than the commercial cultivars in sugar per ton. HoCP 90-923 and HoCP 90-963 also had good yields in these tests.

1991 Series. Six HoCP's and one Ho were harvested from first-ratoon and plant-cane in 1994. Two L experimental candidate cultivars were also harvested from the plant-cane test. HoCP 91-527, HoCP 91-552, and HoCP 91-555 were equal to or higher than the commercial cultivars in yields of sugar per ton and sugar per acre in both tests. The nine active candidate cultivars from this series were replanted in 1994. A plant-cane, first-ratoon, and second-ratoon test of the 1991 series will be harvested in 1995.

1992 Series. Seventeen experimental candidate cultivars from the 1992 HoCP and Ho series and two imports from Florida (CP 83-1899 and CP 85-1625) were harvested from a plant-cane infield test in 1994. In this test, HoCP 92-675 and CP 83-1899 were significantly higher than the commercial cultivars in sugar per acre. These nineteen candidate cultivars were replanted in 1995.

1993 Series. Thirty-six HoCP and six Ho experimental cultivars were planted in an infield test in 1994. **(E.O. Dufrene)**

Outfield Selection. Outfield selection is the final stage in evaluating candidate cultivars for release to the Louisiana sugarcane industry. Outfield selection is a cooperative effort between USDA-ARS, Louisiana State University Agricultural Center, and the American Sugar Cane League. The work is conducted in cooperation with sugarcane growers at 13 locations throughout the sugarcane belt of Louisiana. Candidate cultivars are tested in replicated experiments [3 replications, with each plot 3 rows (18 ft) wide x 32 ft long] in the plant-cane, first-ratoon, and second-ratoon crops on both light and heavy soil. A minimum of seven commercial cultivars are included as controls in each outfield test.

In 1993, two new cultivars were released for commercial planting, LCP 85-384 and HoCP 85-845. In 1993, LCP 85-384 had significantly greater yields in sugar per acre than CP 70-321 on light and heavy soils. LCP 85-384 is a excellent stubbling cultivar and produces good tonnage from many small stalks. This cultivar is resistance to smut and sugarcane mosaic but is susceptible to the sugarcane borer. LCP 85-384 is generally erect but brittle if lodged at harvest. HoCP 85-845 produced yields in sugar per acre in 1993 that were not statistically different from CP 70-321. This is a good harvesting cultivar and is resistant to mosaic, smut, and the sugarcane borer. HoCP 85-845 is susceptible to leaf scald. Although, HoCP 85-845 was released in 1993 it was not distributed from secondary stations for commercial planting because of its apparent susceptibility to leaf scald. It is still too early to know if leaf scald will affect the yield of this cultivar.

Average yield of sugar per acre in outfield tests in the plant-cane, first-ratoon, and second-ratoon crops on light and heavy soils during 1993.

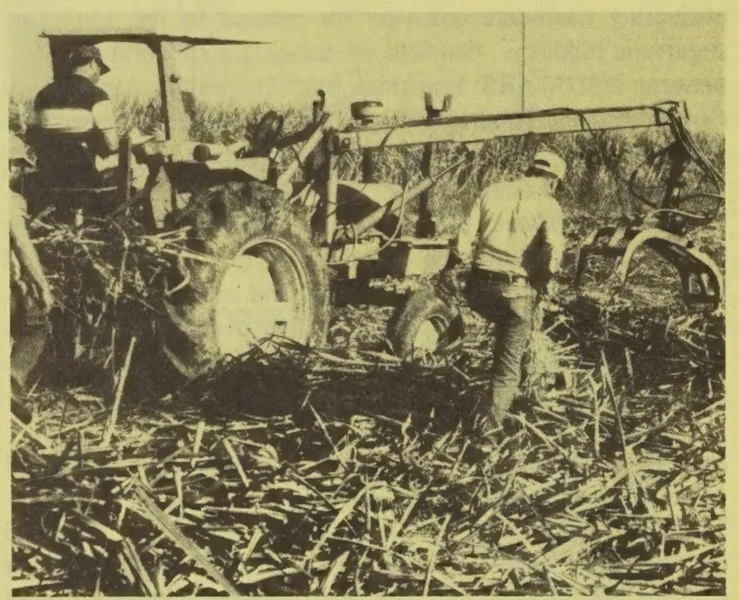
	Crop year		
Cultivar	Plant-cane	First-ratoon	Second-ratoon
		lbs	
CP 70-321	5542	5268	5505
LCP 85-384	6302	7686	7000
HoCP 85-845	6120	5655	5651

LCP 86-454 was released for commercial planting in 1994. In 1994, yields in sugar per acre for LCP 86-454 were not statistically different from CP 70-321. LCP 86-454 is a good

harvesting cultivar with large stalks and low population. The cultivar is resistant to smut and the sugarcane borer. **(D.D. Garrison)**

Average yield of sugar per acre in outfield tests in the plant-cane, first-ratoon, and second-ratoon crops on light and heavy soils during 1994.

	Crop year		
Cultivar	Plant-cane	First-ratoon	Second-ratoon
	lbs		
CP 70-321	6443	6159	4905
LCP 86-454	6791	6937	5245



Hydraulic weigh rig.

Notice of Release of Sugarcane Cultivar HoCP 85-845. The Agricultural Research Service of the U.S. Department of Agriculture, the Louisiana Agricultural Experiment Station of the Louisiana State University Agricultural Center, and the American Sugar Cane League of the U.S.A., Inc., working cooperatively to improve sugarcane cultivars, jointly developed and released a new cultivar, HoCP 85-845, for commercial planting in the fall of 1993.

HoCP 85-845 is a product of the cross CP 72-370 x CP 77-403 made at Canal Point (CP), Florida and selected at Houma (Ho), Louisiana, and has a high population of medium sized, green stalks. The cultivar is a BC_4 progeny derived from the original cross CP 52-1 x *Saccharum spontaneum* clone US 56-15-8. HoCP 85-845 is erect in growth habit and suited to mechanical harvesting. Yield data from a total of 55 mechanically harvested replicated trials on both light- and heavy-textured soils indicate that HoCP 85-845 is superior to CP 70-321, the leading commercial cultivar in yield of total recoverable sugar per acre in the plant-cane crop and yield of cane per acre in the plant-, first-, and second-ratoon crops. HoCP 85-845 is similar to CP 70-321 in recoverable sugar per ton of cane and maturity. The cultivar has acceptable fiber content (13.05%) and a milling factor of 1.016, similar to the commercial check CP 65-357.

The cultivar is moderately resistant to sugarcane mosaic virus, is resistant to smut caused by *Ustilago scitaminea* Syd. & P. Syd., and is resistant to rust caused by *Puccinia melanocephala* H. & P. Syd. under Louisiana field conditions. Ratoon stunting disease (*Clavibacter xyli* subsp. *xyli*) has caused significant reductions in yield of cane and total recoverable sugar per acre of this cultivar in the ratoon crop. HoCP 85-845 is resistant to the sugarcane borer, *Diatraea saccharalis* F. **(R.D. Plowman, K.W. Tipton, and B.B. Beyt)**

Notice of Release of Sugarcane Cultivar LCP 85-384. The Louisiana Agricultural Experiment Station of the Louisiana State University Agricultural Center, the Agricultural Research Service of the U.S. Department of Agriculture, and the American Sugar Cane League of the U.S.A., Inc., working cooperatively to improve sugarcane cultivars, jointly developed and released a new cultivar, LCP 85-384, for commercial planting in the fall of 1993.

LCP 85-384 was selected from progeny of the cross CP 77-310 x CP 77-407. The cultivar produces very high populations of small diameter stalks with stalk weights less than CP 70-321. The stalks are light green to almost white and possess leaf sheafs with a high degree of pubescence and a necrotic margin that includes the auricle. Results from 82 replicate trails among 7 years and 17 test locations indicate LCP 85-384 yields superior sugar and cane yields, and stalk populations per area compared to CP 65-357, CP 70-321, and CP 74-383, particularly in the ratoon crops. The recoverable sugar content of the cultivar is similar to CP 65-357 and has a milling factor of 1.024 and a cane fiber content of 12.48%. The cultivar is suited to mechanical harvesting, with harvesting characteristics similar to CP 70-321.

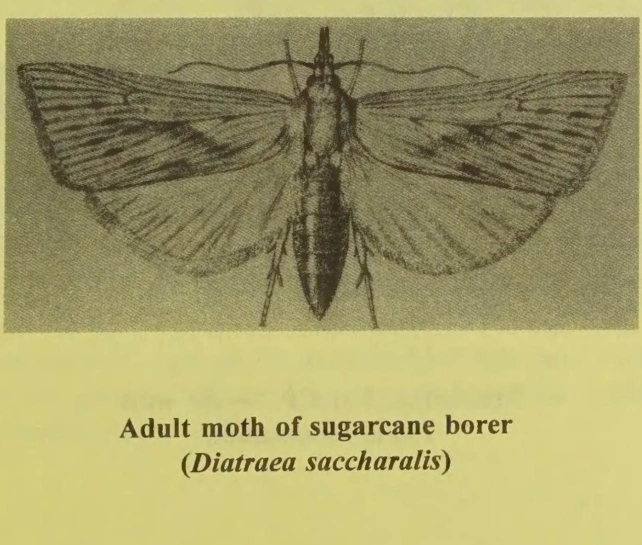
LCP 85-384 is susceptible to injury caused by the sugarcane borer, *Diatraea saccharalis* (F.). LCP 85-384 is moderately resistant to smut (*Ustilago scitaminea* Syd. & P. Syd.), resistant to the sugarcane mosaic virus, and is susceptible to ratoon stunting disease (*Clavibacter xyli* subsp. *xyli*). Preliminary data suggests that the cultivar is tolerant to herbicides used in sugarcane production. **(K.W. Tipton, R.D. Plowman, and B.B. Beyt)**

Notice of Release of Sugarcane Cultivar LCP 86-454. The Louisiana Agricultural Experiment Station of the Louisiana State University Agricultural Center, the Agricultural Research Service of the United States Department of Agriculture and the American Sugar Cane League of the U.S.A., Inc., working cooperatively to improve sugarcane cultivars, jointly developed and released a new cultivar, LCP 86-454, for commercial planting in the fall of 1994.

LCP 86-454 was selected from progeny of the cross CP 77-310 x CP 69-380. Results from 89 replicated trials over 7 years and 19 test locations indicate that the yield of sugar and cane per acre of LCP 86-454 are comparable to CP 65-357, CP 70-321, and CP 74-383. The cultivar produces low stalk populations. The stalk number per area is less than that of CP 70-321 in plant-cane and similar in ratoon crops. The stalks of LCP 86-454 are larger in diameter and greater in weight than those of the check cultivars in all crops. The recoverable sugar content of the cultivar is similar to CP 65-357 and has a milling factor of 1.035 and a cane fiber content of 12.6%. The cultivar is suited to mechanical harvesting, with harvesting characteristics similar to CP 72-370 and CP 74-383.

LCP 86-454 is resistant to injury caused by the sugarcane borer, *Diatraea saccharalis* (F.), is resistant to smut (*Ustilago scitaminea* Syd. & P. Syd.), moderately resistant to leaf scald (*Xanthomonas albilineans*), susceptible to the sugarcane mosaic virus, and susceptible to ratoon stunting disease (*Clavibacter xyli* subsp. *xyli*). Preliminary data suggest that the cultivar is tolerant to herbicides used in sugarcane production. **(K.W. Tipton, H.J. Brooks, and B.B. Beyt)**

Recurrent Selection for Sugarcane Borer Resistance (RSB). Progress continues in selecting for borer resistance. The RSB program currently has produced 19 clones with levels of borer resistance exceeding commercial cultivars currently recommended to Louisiana cane farmers. These cultivars constitute our S2 cycle and are currently being intercrossed to begin selection for the S3 cycle. Additionally, RSB selections are used as resistant parents in crosses made for the commercial program. Since the 1989 series, an average of approximately 45% of the seedlings transported to the field for the commercial program were the progeny from crosses involving at least one RSB parent. **(W.H. White and B.L. Legendre)**



Adult moth of sugarcane borer (*Diatraea saccharalis*)

Cycle 2 RSB parents and their yield in the plant-cane crop expressed as percent of CP 70-321.[1/]

Selection[1/]	Parentage	CRS (kg Mg^{-1})	Cane (Mg ha^{-1})	Sugar (kg ha^{-1})
		%	%	%
US 90-18	CP 79-348/CP 83-657	95	85	87
US 90-21	CP 79-332/CP 83-657	92	76	69
US 90-24[2/]	CP 79-332/CP 83-657	77	105	81
US 90-26[2/]	CP 79-348/CP 83-657	98	90	87
US 90-27[2/]	CP 81-332/CP 83-632	90	111	101
CP 90-987[2/]	CP 79-332/CP 83-657	115	72	84
CP 91-573[2/]	CP 65-357/CP 70-321	119	119	142
CP 91-574[2/]	CP 82-550/CP 83-657	113	83	94
CP 91-575[2/]	CP 83-644/LCP 82-89	107	182	195
CP 91-576[2/]	CP 79-318/CP 70-321	108	91	97
US 92-10[2/]	HoCP 85-845/CP 83-657	117	104	120
US 92-11[2/]	HoCP 85-845/CP 70-321	76	103	79
US 92-12[2/]	LCP 84-222/US 87-20	94	111	105
CP 92-678	HoCP 85-845/CP 83-657	89	114	102
US 93-15	CP 85-861/CP 85-834	67	100	67
US 93-16	LCP 84-222/CP 85-834	89	110	100
US 93-17	HoCP 85-845/CP 84-742	104	115	123
CP 93-775	CP 86-916/CP 85-830	116	100	168
CP 93-776	HoCP 85-845/CP 84-742	117	148	178

[1/] All cultivars initially clustered in the most resistant group; however, selections are repeatedly evaluated as new assignments are made.

[2/] These selections clustered out of the most resistant group in the 1994 and will be de-emphasized in the 1995 crossing campaign and will eventually be dropped out of the RSB population.

Harvestability of Recently Released Louisiana Sugarcane Cultivars. Presently, most Louisiana sugarcane farmers use soldier-type harvesters; therefore, harvestability of new cultivars is important to growers and researchers. Three recently released cultivars, LHo 83-153, LCP 85-384, and HoCP 85-845, plus seven older cultivars, CP 65-357, CP 70-321, CP 72-370, CP 74-383, CP 76-331, CP 79-318, and LCP 82-89, were mechanically harvested with a single-row harvester in the plant-cane and first-ratoon crops in 1993 and 1994, in a harvestability test at the Ardoyne Farm, Houma, LA. Data collected were stalk brittleness using a hand-held stalk breaking device (SBD), erectness rating at time of harvest, percent scrap after harvest, and percent of stalks damaged by the harvester. An analysis from the two crop years indicated that LHo 83-153 and HoCP 85-845 were equal to the best harvesting commercial cultivars, CP 65-357, CP 72-370, and CP 74-383, in the percent scrap after harvest, percent of stalks damaged by the harvester, and erectness rating. LCP 85-384 had the highest percent scrap and percent of stalks damaged by the harvester when compared to all other cultivars and had a lower erectness rating (was less erect) than CP 65-357, CP 72-370, or CP 74-383. However, LCP 85-384 was significantly higher in sugar per acre than CP 65-357, CP 74-383, or LHo 83-153, regardless of the amount of scrap left in the field. **(E.O. Dufrene, D.D. Garrison, and B.L. Legendre)**

Inheritance Studies on Self-Stripping Character. In an effort to study the feasibility of selection for self-stripping in sugarcane which could reduce the need for burning, improve overall cane and juice quality, and better facilitate green-cane harvesting, a study involving 24 crosses with parental clones of self-stripping (SS) or tight clinging (TC) leaves and accompanying leaf sheaths was begun in the spring of 1993. Two hundred eighty-eight seedlings (clones) each of the 24 crosses representing SS x SS (Combination 1), SS x TC (Combination 2), TC x SS (Combination 3), and TC x TC (Combination 4) parental combinations were set to the field in a four replicate, randomized complete block design with 72 clones per replicate.

Little or no differences were noted in self-stripping behavior in the plant-cane crop of the single-stool stage, probably due to the immaturity of the crop (six months) at selection; however, there were significant differences noted in the first-ratoon crop. Progeny of crosses with the best ratings for self-stripping occurred in the crosses between two self-stripping parents; whereas, progeny with the worst ratings occurred in the crosses between two tight clinging parents with the remaining progenies intermediate. A second assessment was made on November 2, 1994 where the first 40 clones of each plot were divided into three groups: 1) the number of clones with more than 50% leaves shedding (clean); 2) number with the majority of leaves loosely attached but still attached to stalk (loose); and 3) the number of clones with tight clinging leaves (clinging). The correlation coefficients between the ratings for self-stripping and number of clones with clean, loose, and clinging leaves and leaf sheaths were $r = -0.858$, -0.898, and 0.915, respectively, showing very good agreement. Further, the correlation coefficient between the ratings for self-stripping and the number of clones selected for the self-stripping character and replanted to 6-foot line (clonal) trials ($n = 381$) for the 24 crosses was $r = -0.845$, again showing close agreement. These data also showed a moderate association between ratings and agronomic type ($r = 0.576$) and between ratings and overall assessment of the progeny in each cross ($r = 0.548$) but no association between ratings and erectness of stalks ($r = 0.050$). Overall, the data suggest that selection for the self-stripping character is feasible and that the self-stripping type may be associated with overall agronomic type. **(B.L. Legendre)**

CYTOLOGY

Sugarcane species are polyploids possessing 4 to 12 or more sets of chromosomes. Chromosome number and pairing have been determined for many elite and exotic clones used in the breeding program. This information is useful in predicting genetic composition and stability for breeding and molecular biology studies, taxonomy, and confirming clonal identity.

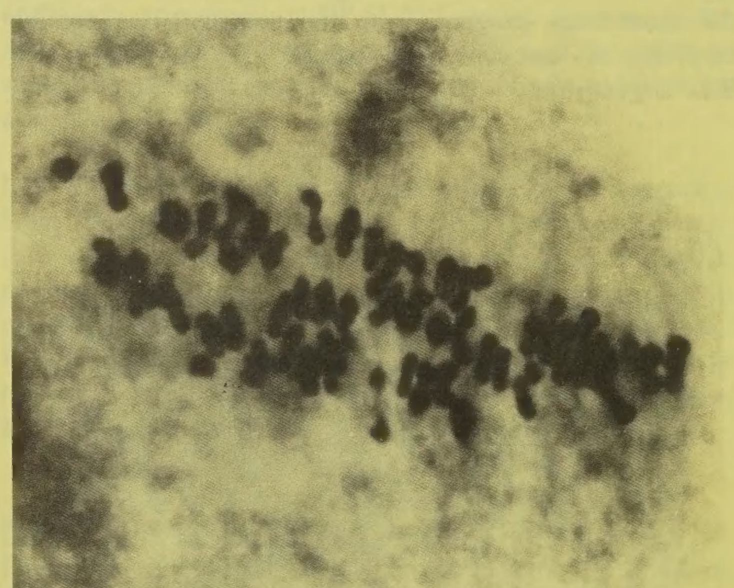
Cytological studies were made of 21 elite clones used in breeding. Normal chromosome pairing predominates in most clones, although many exhibit aneuploidy (uneven number of chromosomes) and chromosomal mosaicism (chromosomes vary in number among cells within the plant) causing eggs and pollen to vary in chromosome number. This demonstrates that the genetics of sugarcane is quite complex.

A cytological study was conducted of 60 clones representative of the eight species and cultivars of sugarcane native to North America. Chromosome pairing was normal in all clones. Counts were made for the first time for *S. brevibarbe* var. *brevibarbe* (2n=60), *S. coarctatum* (2n=60), and *S. giganteum* (2n=30, 60, and 90). The latter was the first report of a polyploid series within *S. giganteum* and the first report of 2n=90 for this germplasm. Counts also were made for *S. alopecuroideum* (2n=30), *S. baldwinii* (2n=30), and *S. brevibarbe* var. *contortum* (2n=60). Being adapted to North America, unlike sugarcane, these plants may have genes useful in breeding. **(D.M. Burner)**

Chromosome counts for elite sugarcane breeding clones.

Clone	Count	Clone	Count
CP 52-68	108-119[1/]	CP 77-1776	113
CP 61-37	110-111	CP 79-348	112
CP 61-39	104	L 60-25	112-115
CP 62-258	114	L 62-96	106-112
CP 65-357	104-115	L 65-69	108
CP 67-412	110	L 83-193	99-110
CP 70-1133	108-118	LCP 81-10	106
CP 70-321	110	LCP 81-30	105, 108
CP 70-330	109	LCP 82-89	109-116
CP 72-355	110	NCo 310	112
CP 74-383	104, 108-109		

[1/] Plants with a range of chromosome number appeared to be chromosomal mosaics. The most frequently observed count was underlined.



Metaphase I of CP 74-383 with 108 chromosomes.

PLANT PATHOLOGY

Sugarcane Mosaic. Cultivars of sugarcane differ in the amount of yield loss caused by infection with the sorghum mosaic virus (SrMV). Among the nine currently recommended cultivars, two are resistant to the SrMV, LHo 83-153 and LCP 85-384; one is moderately resistant, HoCP 85-845; and the others vary from susceptible to moderately susceptible. By incorporating resistance from wild sugarcane relatives and the identification and use of resistant parents, mosaic resistance among the progeny of the most recent crosses has increased.

Samples of sugarcane plants showing mosaic symptoms were collected from across the sugarcane industry for over 20 years. Strains of the infecting virus were identified by inoculating differential host plants. Strain H of SrMV was predominant throughout the period. Strain I was the second most commonly recovered strain with the incidence the highest when the susceptible cultivar NCo 310 was a commonly grown cultivar. Strain M was recovered intermittently. **(M.P. Grisham)**

Sugarcane Smut. Candidate cultivars of sugarcane are screened for resistance to smut (*Ustilago scitaminea*) by dip inoculating seed cane in a 5 x 10^6 teliospores per ml suspension for 10 minutes prior to planting. The mean percent shoots infected is used to group the candidate cultivars into resistant, intermediate, and susceptible classes. The 1992 series of experimental cultivars had not been previously screened in an inoculated test. The high percentage of candidate cultivars in the resistant and intermediate classes among the 1987-90 series reflects the elimination of highly susceptible candidate cultivars exposed to earlier natural inoculation and better parent selection for resistance to smut. **(B.L. Legendre and M.P. Grisham)**

Number and percent of CP, LCP, and L sugarcane candidate cultivars assigned to three smut resistance classes following the 1993-94 inoculated trial.

Series of cultivars	Resistance classes					
	Resistant		Intermediate		Susceptible	
	No.	%	No.	%	No.	%
1987-90	21	95	0	0	1	5
1991	18	60	7	23	5	17
1992	28	85	4	12	1	3
Total	67	79	11	13	7	8

Ratoon Stunting Disease. The effect of ratoon stunting disease (RSD), caused by *Clavibacter xyli* subsp. *xyli*, was determined for eight of the recommended cultivars. Yield of diseased-infected plants was compared to the yield of uninfected plants. **(M.P. Grisham)**

Percent loss of yield (pounds sugar per acre) in sugarcane caused by ratoon stunting disease (RSD) between 1992 and 1994.

Cultivar	Crop		
	Plant-cane	First-ratoon	Second-ratoon
		%	
CP 65-357	19**[a]	(6)	15
CP 70-321	(5)[b]	6	(4)
CP 79-318	(9)	4	5
HoCP 85-845	14**	18**	21**
LCP 82-89	12*	15	3
LHo 83-153	13	17	23*
LCP 85-384	(9)	13	6
LCP 86-454	16	17	14

[a] Mean of four replicates. * = significant at P = 0.05, and ** = significant at P = 0.01.

[b] ( ) = RSD-infected had higher yield than healthy.

Leaf Scald. Leaf scald, caused by *Xanthomonas albilineans*, was first observed in clonal trials at the Sugarcane Research Unit's farm on 3 November 1992. An extensive survey of locations throughout the industry was conducted during 1993. Leaf scald was detected in both commercial and candidate cultivar development plantings in 12 of 18 parishes in which sugarcane is grown. The greatest number of commercial fields affected and the highest incidence were observed among cultivars CP 74-383 and LCP 82-89. An evaluation of the susceptibility of Louisiana cultivars and advanced breeding clones was made. The results of two inoculated tests are shown for current commercial cultivars. **(M.P. Grisham and B.L. Legendre)**

Percent stalks infected and severity rating of sugarcane cultivars artificially inoculated with *Xanthomonas albilineans*, cause of leaf scald.

	1993[1]		1994	
	% Inf.	Ave. severity[2]	% Inf.	Ave. severity
CP 65-357	57	3.7	56	5.0
CP 70-321	49	2.5	23	3.0
CP 72-370	60	4.3	8	2.3
CP 74-383[3]	92	6.4	45	8.3
CP 79-318	48	2.1	20	3.0
HoCP 85-845	84	4.2	24	5.0
LCP 82-89	71	3.3	34	4.3
LCP 85-384	5	1.1	0	1.0
LHo 83-153	21	1.6	0	1.0

[1] Plants in the 1993 test were subjected to much greater stress than the 1994 test.

[2] Severity was determined for inoculated shoots. Severity ranged from 1 = no symptoms to 9 = acute symptoms including dying of upper leaves and premature germination of buds along entire length of stalk.

[3] Susceptibility to leaf scald contributed to the removal of CP 74-383 from the list of sugarcane cultivars recommended for Louisiana.

ENTOMOLOGY

Sugarcane Recovery From Spring Stand Losses Associated With Simulated Insect Feeding as Influenced by Soil-Applied Herbicides. The influence of spring sugarcane shoot loss associated with simulated insect feeding was investigated in field studies by removing 0, 25, 50, and 75% of the emerged sugarcane shoots 0.75 to 1.5 in below the soil surface in mid-March, mid-April, and mid-May in plant-cane and first-ratoon fields of sugarcane. The effects of spring stand reductions on sugar yield and its components were determined at the end of the growing season and in ratoon crops remaining in a conventional, Louisiana 3-yr crop cycle. Yields of sugar decreased with each successive date of shoot removal during the crop yr in which the damage occurred. Sugar yields were affected by a 25% removal of shoots only when the removal occurred in mid-May during the first-ratoon crop. Reductions in sugar yield associated with April and May removal dates were generally higher when shoots were removed during the first-ratoon than the plant-cane crop. Total sugar yields for the affected and subsequent ratoon crops were reduced, particularly when 75% of the shoots were removed in mid-April or mid-May. Reductions in cumulative sugar yields were not as great as the reductions in the affected crop. Yearly and cumulative sugar yields were higher when metribuzin was applied each spring than when fenac or terbacil was applied; however, none of these herbicides appeared to influence how quickly the affected crop and subsequent crops recovered. Reductions in yearly profits were significantly greater than the reductions in sugar yield following stand reductions in the spring when averaged over an 8-yr, two crop cycle, payback period. Despite the significant reduction in profit, in no instance did the damage incurred by the early season stand loss and associated yield losses in this study warrant the destruction of the crop prior to the completion of its 3-yr crop cycle. **(W.H. White and E.P. Richard Jr.)**

JUICE, CANE, AND MILLING QUALITY

Juice and Milling Quality. An average of 6,910 samples were processed and analyzed in the Juice and Milling Quality Laboratory at the Ardoyne Farm, Houma, LA during the 1993-94 and 1994-95 harvest seasons which commenced about mid-September and ended mid-December each harvest season. User scientist included: American Sugarcane League of the U.S.A., Inc. (ASCL), Thibodaux, LA; Crops Genetics International (CGI), Kenner, LA; Louisiana Agricultural Experiment Station (LAES), Baton Rouge, LA; Nicholls State University (NSU), Thibodaux, LA; Sugar Processing Research Institute, Inc. (SPRI), New Orleans, LA; and United States Department of Agriculture, Agricultural Research Service (USDA-ARS), Houma and Baton Rouge, LA. The traditional 3-roller mill was used for approximately 74% of the total samples. Extracted juice (40-50% by weight of cane) was analyzed for Brix by refractometer and sucrose by polarization using the clarifying agent, aluminum chlorohydrate. From these data and the use of a Varietal Correction Factor (VCF) (Legendre and Henderson, 1972), the estimated yield of theoretical recoverable sugar per ton of cane (TRS/TC) was calculated for each sample. The VCF takes into consideration the fiber and juice extraction % cane obtained from prior tests for each cultivar as well as considers the potential sugar loss in the final molasses using the Winter-Carp formula. The prebreaker/press method was used for the remaining 26% of the total samples. Data obtained for each sample included Brix % cane, sucrose % cane, and fiber % cane. From these data, TRS/TC was calculated directly (Legendre, 1992). These results are similar to predicted values for TRS/TC using the core/press method employed at 19 of the State's commercial mills. The prebreaker/press method is particularly useful to those experiments where the cane quality may be affected by factors other than the cultivar, i.e. borers, weeds, diseases, trash, etc.

Several studies were conducted in both 1993 and 1994 with the pre-breaker/press procedure to determine the effects of field soil, trash (both sugarcane and weeds), and the sugarcane borer on quality parameters to include Brix, sucrose, sediment correction, fiber content, and the yield of TRS/TC. A complete summary of these studies can be found in other sections of these annual reports. **(B.L. Legendre and C.K. Finger)**

Experimental Combine Harvester. The Juice Quality Lab is also equipped to conduct dextran analyses using the ASI II procedure. Accordingly, dextran analyses were conducted on post-harvest samples of whole-stalk and billeted cane of LCP 82-89 obtained from special studies conducted in 1994 with an experimental combine harvester supported, in part, by the ASCL. Samples were taken for dextran at 1 (Nov. 21), 2 (Nov. 22), 3 (Nov. 23), 5 (Nov. 25), and 8 (Nov. 28) days after harvest on billeted cane as well as whole-stalk cane.

Purity was significantly higher in billeted cane for the first day after harvest, no different at 2 and 3 days, and significantly lower at 5 and 8 days after harvest. These data indicated that the quality of juice of billeted cane was inferior to whole-stalk cane after 3 days but before 5 days after harvest. The data for TRS/TC also indicated that billeted cane showed significant deterioration after 3 days. The higher TRS/TC for billeted cane at 1-3 days after harvest was, undoubtedly, due to dehydration of the cane samples prior to milling which helped concentrate the sucrose content of juice. It has been shown in previous studies that dextran content of the juice is a more sensitive test for signs of deterioration than either purity or sucrose levels. In the present study, there was a significantly higher level of dextran in the juice of billeted cane at even 1 day after harvest, indicating that deterioration had already begun. Further, there was a significant difference throughout the sampling period; however, the level of dextran, even in the juice of the billeted cane, was below the threshold which would normally equate to a penalty level for dextran in the sugar produced from that juice. **(B.L. Legendre and C.A. Richard)**

Purity, yield of theoretical recoverable sugar per ton of cane (TRS/TC), and dextran content for whole-stalk (W) and billeted (B) cane of LCP 82-89.

Day (Date)	Purity W	Purity B	TRS/TC W	TRS/TC B	Dextran W	Dextran B
	—— % ——		—— lb ——		—ppm on solids—	
1 (11-21-94)	86.4	87.9*	253	270*	303	789
2 (11-22-94)	88.4	90.1	270	301*	329	745*
3 (11-23-94)	87.8	86.7	268	281*	359	676*
5 (11-25-94)	90.9	81.2*	289	246*	326	574*
8 (11-28-94)	84.0	72.8*	256	222*	261	559*

* Significantly different at the P = 0.05.

Near Infra-red Spectrophotometer. In cooperation with Sugar Processing Research Institute, Inc., (SPRI), during both 1993 and 1994, a NIR/Systems Model 6500 scanning near infra-red spectrophotometer (NIR), with appropriate software, was tested for analysis of first extracted sugarcane juice without filtration for Brix and sucrose. Tests were also continued with near infra-red spectrophotometer in conjunction with the core laboratory at M.A. Patout and Sons (Enterprise Factory) for analysis of whole cane for fiber and bagasse for moisture. Indications are that whole cane from the first mill (crusher) is not suitable for direct reflectance analysis with current equipment: cane pieces are too large to allow adequate computer averaging over the current cell surface (60 cm^2). However, results using a near infra-red spectrophotometer for cane from a cutter-grinder show good correlation to present methods for moisture analysis. Further, results for cane from a shredder, with pieces of finer, more uniform sized, show good correlation for sucrose, moisture, Brix, and fiber (by difference). **(B.L. Legendre and M.A. Clarke)**

Field Soil, Sediment Correction, and Sugar Yield. In an attempt to further quantify the effects of field soil on the yield of theoretical recoverable sugar per ton of cane (TRS/TC), studies were conducted in both 1993 and 1994 where field soil, cane trash, and a combination of field soil and cane were added to clean cane of two cultivars, CP 65-357 and CP 70-321. At times, sugarcane in Louisiana is delivered to the mill for processing with excessive field soil from the harvesting and loading operation. In the core/press method described by Legendre (1992) for predicting TRS/TC from cane for use in cane payment, approximately 30% of this field soil is extracted with the juice while 70% is retained in the residue (bagasse). The effect of these solids in the juice is to inflate the juice content of the cane while decreasing the "fiber" (true fiber plus non-cane solids) content of the cane, resulting in an overestimation of the sugar yield. However, adjustments to this overestimation can be made though the use of the sediment correction. Thus, in reality, the total insoluble residue consisting of natural cane fiber, fiber in cane leaves, tops, and other forms of plant material, and field soil should all be considered in calculating total fiber in cane when using the core/press method.

The results of these investigations showed that there were no differences by cultivar and year; therefore, the results will be presented for 1994 only. Field soil, cane trash, and the combination of field soil and cane trash all caused significant reductions in sucrose % cane with each successive increase in trash, regardless of the makeup of the trash. However, field soil had no effect on cane purity while cane trash and the combination of field soil and cane trash had a significant deleterious effect. Fiber % cane increased significantly no matter what form of trash was added; however, it appeared that field soil alone increased fiber content the greatest. Overall, no matter what form of trash was added, all had generally the same impact on lowering TRS/TC, approximately 3 lb reduction per 1% of trash. These studies also showed that there was not a straight line relationship between the amount of field soil added and the sediment volume. These studies indicated that the greater the amount of field soil in the cane, the greater will be the sediment volume per percent field soil. According to previous studies, it was thought that the amount of soil removed by the press was constant; however, to the contrary, the amount of soil entering the juice increased as the amount of field soil increased in the cane. Further studies are necessary to confirm these findings. Lastly, in a previous study conducted in 1993 only, trash in the form of water reduced TRS/TC by 5% or more. In this study, water was added to approximate rainfall. **(B.L. Legendre)**

Sucrose and fiber % cane, yield of theoretical recoverable sugar per ton of cane (TRS/TC), and sediment volume for two cultivars, CP 65-357 and CP 70-321, as affected by the addition of field soil (FS), cane trash (CT), and a combination of field soil and cane trash.

Cultivar	Treatment	Sucrose % cane	Fiber % cane	TRS/TC	Sediment volume
		——— %	———	lb	%
CP 65-357	Clean Cane	15.59 A	11.48 H	279 A	0.9 H
and	Cane with 10% FS	14.60 B	16.43 FG	251 B	14.0 E
CP 70-321	Cane with 20% FS	12.95 E	23.58 C	207 E	34.5 B
combined	Cane with 30% FS	11.94 G	27.44 A	182 G	60.5 A
	Cane with 10% CT	14.29 C	15.85 G	243 C	3.2 G
	Cane with 20% CT	13.29 D	19.18 E	217 D	3.4 G
	Cane with 30% CT	12.20 F	22.98 C	189 F	3.0 G
	Cane with 5% FS + 5% CT	14.18 C	17.09 F	241 C	9.9 F
	Cane with 10% FS + 10% CT	13.21 D	21.75 D	214 D	19.2 D
	Cane with 15% FS + 15% CT	12.03 FG	26.14 B	183 G	24.9 C
	Mean	13.43	20.19	221	17.3

Milling Studies of Candidate Cultivars. In milling studies conducted in 1993 and 1994, 3 of 37 candidate cultivars, HoCP 91-534, HoCP 91-552, and Ho 91-566, had fiber levels exceeding 15% on clean cane, which, in the past, was

considered too high for consideration of a candidate cultivar for commercial release; however, in recent years, several processors have indicated that fiber levels in released cultivars are too low for energy self-sufficiency. This could mean that cultivars with higher fiber levels may be considered for commercial release in the future. However, higher fiber content results in lower juice extraction and, for each 1 percentage point increasing fiber content, there is a corresponding loss of approximately 4.5 lb of sugar that remains with the fiber. Therefore, there must be a balance between fiber content and sucrose extraction. All three cultivars mentioned above had corresponding milling factors (Varietal Correction Factors or simply VCFs) of approximately 0.980 which means that, with the same Brix and sucrose, these candidate cultivars would yield approximately 3% less sugar per ton than the commercial standard, CP 65-357, with a VCF of 1.014. Eleven additional candidate cultivars, CP 85-1625, L 89-113, HoCP 90-977, HoCP 91-559, L 91-250, HoCP 92-618, HoCP 92-629, HoCP 92-631, HoCP 92-644, HoCP 92-664, and HoCP 92-678, have fiber levels exceeding 14% and a VCF of approximately 1.000. The remaining 23 candidate cultivars appear acceptable for fiber content and milling quality under the current standards. **(B.L. Legendre)**

<u>Natural Maturity</u>. In 1990, the industry was still feeling the effects of the Christmas-time freeze of Dec. 1989; in 1991, the industry experienced the effect of record rainfall; and, in 1992, the industry witnessed the effects of Hurricane Andrew. Undoubtedly, the maturity of commercial and candidate cultivars was affected by these natural calamities. In 1993, weather conditions were near "normal" at Houma although much of the industry experienced long periods without rainfall during the summer months and rainfall during the harvest that may have again affected the maturity curves of both commercial and candidate cultivars. In 1994, the industry experienced one of its best crops since 1989 with sugar production exceeding 1 million tons for the first time in its history. Cultivar selection for early and high sucrose, the use of chemical ripeners, and generally favorable weather during the harvest played a large part in these record yields.

The relative maturity of all cultivars in 1994 in both the first-ratoon and the plant-cane crops was similar to that found in 1993. These results reinforced the early maturity of CP 72-370, HoCP 85-845, and LCP 86-454 and the high sucrose potential of LCP 82-89, LHo 83-153, and LCP 85-348 after mid season. Further, the Louisiana industry as a whole, saw the potential for these and all other cultivars under generally ideal harvest conditions. Actual factory sugar yield (commercial recoverable sugar) approached 10.5%; however, the potential is now there with the newer cultivars for a season average exceeding 12% recovery on gross cane. The key is quality, trash-free cane delivered to the factories for processing. Additional studies in 1994 on the effect of trash reconfirmed that there is a loss of approximately 3 lb TRS/TC for every 1% trash (cane or weedy trash or field soil alone or in combination). With the average trash in delivered cane at an estimated 10%, the industry is losing approximately 30 lb of sugar on every gross ton of cane delivered to the factory. **(B.L. Legendre)**

Natural maturity in the plant-cane and first-ratoon crops as measured by the yield of theoretical recoverable sugar per ton of cane (TRS/TC) in trash-free cane[1/].

	TRS/TC (lb)			
	Plant-cane crop		First-ratoon crop	
Year	Oct. 1	Dec. 1	Sept. 15	Dec. 15
1990	172	255	156	268
1991	183	237	170	232
1992	176	275	156	295
1993	182	240	182	282
1994	183	256	188	292

[1/] Average of three cultivars, CP 65-357, CP 70-321, and CP 72-370.

WEED CONTROL AND CULTURAL PRACTICES[a/]

<u>Johnsongrass Competition With Sugarcane</u>. Studies with johnsongrass infestations, which began as seedlings in the plant-cane crop of cultivar CP 65-357 sugarcane, revealed several important relationships between johnsongrass interference and sugarcane growth and yield: (1) rhizomatous johnsongrass infestations developed rapidly from relatively moderate initial seedling infestations in the plant-cane crop, showing the importance of maintaining very high levels of seedling johnsongrass control in this crop; (2) plant-cane did not compete effectively with March-germinating johnsongrass because of slow cane growth under the typically cool March temperatures, but the cane effectively suppressed seedlings that germinated in May as sugarcane growth and tillering accelerated at the warmer temperatures; (3) when uncontrolled, rhizomatous johnsongrass infestations that began in the plant-cane crop, overwintered and began to compete with sugarcane early in the spring, causing greater yield loss in the first-ratoon crop than in the plant-cane crop; (4) sugarcane population and cane and sugar yield decreased as the period of johnsongrass interference increased during each crop year. Johnsongrass removed in May, June, July, and at the November harvest in each crop reduced cane yield 3, 10, 19, and 23%, respectively, in the plant-cane crop and 7, 15, 25, and 42% in the first-ratoon crop, respectively, as compared to weed-free controls. In another experiment with a higher infestation of johnsongrass and a lower population of sugarcane, yield reduction in the second-year crop was 8, 27, 63, and 86%, respectively. The data indicate that major yield loss can be prevented by removing (controlling) johnsongrass in early May before johnsongrass growth accelerates; (5) Johnsongrass interference primarily affected cane yield by reducing stalk population and did not adversely affect stalk weight except where johnsongrass populations were very high; and (6) sugarcane recovered substantially from two years of johnsongrass interference when maintained weed-free in the

third year, indicating that the effects of johnsongrass interference are reversible as long as most sugarcane stools survive the competitive effects of the johnsongrass. **(R.W. Millhollon)**

Rhizome and Seedling Johnsongrass Control. In a 2-year study, johnsongrass sprouts emerging in the fall from rhizome buds were controlled in sugarcane at planting by preemergence applications of sulfometuron and imazapyr but not by similar applications of metribuzin and a tank mixture of pendimethalin plus atrazine. Applications of imazapyr and sulfometuron in mid-March to emerged sugarcane were too injurious to the crop. In other studies, mid-March applications of clomazone and thiazopyr provided preemergence control of seedling johnsongrass at levels equivalent to those obtained with standard applications of metribuzin, pendimethalin, and terbacil. Sugarcane leaves contacted by clomazone-containing spray droplets became completely chlorotic within 10 days. However, injury was temporary and did not affect sugarcane development or cane and sugar yields. Postemergence control of rhizomatous johnsongrass within LCP 82-89 plant-cane with nicosulfuron and primisulfuron was compared to a standard postemergence application of asulam. Asulam at a broadcast rate of 3.34 lb ai/acre provided 79% control of johnsongrass and increased sugar yields by 19% when compared to a weedy-check. Primisulfuron at 0.18 lb ai/acre controlled johnsongrass and produced sugar yields which were similar to yields observed with asulam. Some sugarcane injury was observed after treatment with primisulfuron, however, injury was temporary as evidenced by the resulting cane and sugar yields. Safeners included in commercial mixes of other sulfonylurea herbicides did not reduce the level of sugarcane injury observed with either nicosulfuron, primisulfuron, or sulfometuron. **(E.P. Richard, Jr.)**

Johnsongrass Control with Asulam. Several studies were conducted to evaluate methods to increase the effectiveness of asulam for control of rhizome johnsongrass in sugarcane. One study evaluated experimental and commercial spray additives which included surfactants of the organosilicone, nonionic, and cationic types; crop oil concentrates; buffers; fertilizers; growth regulators; and combinations. None of the additives improved johnsongrass control or sugarcane yield over the standard treatment of asulam mixed with a nonionic surfactant at 0.5% by volume or a crop oil concentrate at 1.0% by volume. Using a rainfall simulator set to deliver the equivalent of a 0.5 in. rain in 15 minutes, it was found that a rainfree period of as much as 20 hours was needed to insure maximum activity with Asulam. The rainfastness of the asulam was not enhanced by the inclusion of a crop oil concentrate or a commercially blended organosilicone/crop oil concentrate premix. In other studies, the highest levels of johnsongrass control with asulam (70 to 80%) were obtained when asulam was applied before or 7 to 10 days after fertilization. Stress associated with damage to the johnsongrass plant's roots and rhizomes during the tillage practices associated with fertilization (off-barring, fertilizer injection, and cultivation of the row sides to limit fertilizer loss) probably results in a reduction in the amount of asulam absorbed and translocated. **(E.P. Richard, Jr.)**

Biological Control of Johnsongrass. Loose kernel smut of johnsongrass, incited by *Sphacelotheca holci*, is a systemic disease which causes stunted growth and smutted panicles. Plants are not killed by the disease, but crop interference and seed production are reduced. Two johnsongrass interference studies in sugarcane showed that healthy johnsongrass reduced stalk population of a plant-cane crop of sugarcane an average of 60%, whereas, johnsongrass infected hypodermically with smut reduced the population by 30%. However, the smut fungus has proven to be a relatively weak pathogen, and field infection from foliar water sprays of either teliospores or sporidia has been only about 35%. A much higher infection rate must be achieved for this pathogen to have potential as a biocontrol for johnsongrass. **(R.W. Millhollon)**

Itchgrass and Seedling Johnsongrass Control. Pendimethalin generally provides more effective and consistent preemergence itchgrass and seedling johnsongrass control when incorporated than when nonincorporated; however, the goal is to develop preemergence treatments that do not require soil incorporation. In studies over several years, herbicides other than pendimethalin that have shown promise as nonincorporated preemergence treatments for the control of itchgrass and seedling johnsongrass are: clomazone at 1 to 2 lb ai/A, fomesafen at 1 to 2 lb ai/A, and thiazopyr at 0.5 to 1 lb ai/A. Itchgrass control with these herbicides, particularly at the lower rates, has been quite variable and generally less than that with pendimethalin at 3 lb/A. Also, clomazone and fomesafen cause significant although relatively temporary injury to sugarcane. Recent research indicates that clomazone may give more consistent and more effective control of itchgrass with less injury to sugarcane if applied very early in spring so that the chemical is activated by rain well before itchgrass seed germinate and while sugarcane is growing very slowly. **(R.W. Millhollon)**

Pre- and Postemergence Itchgrass Control. Pendimethalin will control itchgrass preemergence but will not provide effective postemergence control of seedlings that are emerged at the time of application. Studies showed that several herbicides in mixtures with pendimethalin and surfactant will provide postemergence control, depending on the size of the seedlings. A mixture involving atrazine plus 2,4-D at 2.4 + 2.4 lb ai/A or terbacil at 1.0 lb ai/A provided control of small itchgrass seedlings less than 2 inches tall. Larger seedlings up to about 5 inches tall with 4 to 5 leaves were controlled with mixtures involving either diuron at 1.5 to 2.0 lb ai/A or ametryn at 2.0 to 2.5 lb ai/A. Seedlings about 10 inches tall were controlled most effectively with asulam at about 3.34 lb ai/A, either applied alone or in a mixture with pendimethalin. Some injury to sugarcane occurred with the diuron and ametryn treatments, but injury was minimized by applying treatments before May 1. **(R.W. Millhollon)**

Bermudagrass Control in Sugarcane. Spring applications of clomazone, metribuzin, and terbacil, but not pendimethalin, provided some suppression (<30%) of bermudagrass but did not increase cane and sugar yield over the weedy control. Dual applications of clomazone at 1.0 and 2.0 lb ai/A or terbacil at 1.4 lb ai/A, applied at planting and in spring, reduced bermudagrass infestations by 31%. Imazapyr and sulfometuron reduced bermudagrass infestations without injuring sugarcane when applied in fall immediately after planting. However, cane injury occurred when these herbicides were applied in spring after cane emergence. Glyphosate at 3 and 4 lb ai/A applied in sugarcane with a shielded sprayer provided good to excellent (>75%) control of bermudagrass growing in the water furrow and on the row sides, provided the interval between cultivation and treatment was greater than 4 weeks. However, bermudagrass growing within the planted line of sugarcane was not controlled adequately, and sugarcane yields were not different from the untreated control. Some crop injury in the form of chlorosis was observed from spring glyphosate treatments as a result of spray drift, but spray drift was reduced by installing curtains on the front and rear of the shield which contacted the ground in the water furrow. In hand-weeding studies, which removed actively growing bermudagrass stolons as well as the winter-killed bermudagrass residues, sugar yields of ratoon sugarcane could be increased by 17% if bermudagrass topgrowth was completely removed in April. The removal of 0.5 to 1 inch of soil from the row top with a revolving disk shaver in late-March also removed the winter-killed bermudagrass topgrowth and reduced bermudagrass infestations by 33% but did not increase sugar yields. The use of shaving in conjunction with the application of clomazone, metribuzin, and terbacil produced greater bermudagrass control than either shaving or herbicide treatment alone. **(E.P. Richard, Jr.)**

Bermudagrass and Johnsongrass Control in Fallowed Sugarcane Fields. Sulfometuron at 2 to 3 oz ai/acre and imazapyr at 0.38 to 0.5 lb ai/acre applied to newly reformed sugarcane beds reduced bermudagrass infestations during the fallow period and in the fall after replanting the crop. The effectiveness of these herbicides in controlling bermudagrass during the fallow period was dependent on tillage (disking) frequency prior to treatment and on the interval between treatment and planting. Bermudagrass infestation levels in the fall after the replanting of the sugarcane crop were also reduced where single postemergence applications of glyphosate at 2 to 3 lb ai/acre and glufosinate at 1.5 to 2.0 lb ai/acre were made to emerged bermudagrass growing on sugarcane beds 2 to 3 weeks prior to the anticipated planting date. Reductions in bermudagrass infestation levels were negated if metribuzin or terbacil was not applied immediately after planting and in the early spring. Plant-cane yields were increased by 5% where sulfometuron or imazapyr was applied preemergence or glyphosate or glufosinate was applied postemergence during the fallow period as opposed to no herbicide treatment. These herbicide treatments also effectively controlled johnsongrass in fallowed fields. As with the control of bermudagrass, the effectiveness of the preemergence treatments for johnsongrass control during the fallow period was dependent on tillage frequency prior to treatment and the interval between treatment and planting. Enhanced bermudagrass and johnsongrass control over that observed with glyphosate applied with a standard nonionic surfactant at 0.5% or a crop oil concentrate at 1.0% was not obtained when glyphosate was applied with other commercially available additives ranging from nonionic surfactants (fatty acid- and organosilicone-based), to crop oil concentrates, to buffers, to ammonium sulfate. At standard use rates, postemergence applications of fluazifop-P and quizalofop failed to control bermudagrass and johnsongrass and the broadleaf weeds and sedges that were also present in the fallowed fields at levels equivalent to that observed with glyphosate. **(E.P. Richard, Jr.)**

Weed control in fallowed sugarcane fields.

[a/] Common name and trade name of herbicides mentioned in this report: asulam = ASULOX; atrazine = AATREX; clomazone = COMMAND; fomesafen = REFLEX; fluazifop-P = FUSILADE 2000; glufosinate = IGNITE; glyphosate = ROUNDUP; imazapyr = ARSENAL; metribuzin = SENCOR/LEXONE; thiazopyr = MON 13211/VISOR; nicosulfuron = ACCENT; pendimethalin = PROWL; primisulfuron = BEACON; quizalofop = ASSURE; sulfometuron = OUST; terbacil = SINBAR.

GROWTH REGULATORS

Chemical Ripeners. Glyphosate (POLADO) is presently labelled as a ripener treatment for ratoon crops of sugarcane, and research was conducted to determine the feasibility of applying glyphosate in the plant-cane crop as well. In one study, glyphosate at 0.3 lb/A was applied annually at 28 to 42 days before the fall harvest in the plant-cane crop and the two subsequent ratoon crops. The treatment consistently increased the sucrose content of juice and in most years increased sugar yield by 6 to 11%. However, a severe freeze (-12 C) occurred soon after harvest of the plant-cane crop, and

in the following ratoon crop, stalk population and cane yield of cultivar CP 65-357 at the 42-day treatment-harvest interval was reduced by about 20% as compared to the untreated control. The cane yield of cultivars CP 70-321 and CP 74-383 were not greatly affected by the combination of glyphosate treatment and the freeze. In a similar study, but with no freeze, glyphosate ripener treatments did not adversely affect cane yield of CP 65-357, CP 70-321, LCP 82-89 and LHo 83-153 in the plant-cane and first-ratoon crops. The ripener treatment increased sugar yield 7% in the plant-cane crop and 11% in the first-ratoon crop as an average of the four cultivars. **(R.W. Millhollon and B.L. Legendre)**

Growth Regulators For Yield Enhancement. Ethephon (ETHREL) was evaluated both as a whole-stalk dip (250 ppm solution for 30 min) at planting in fall, and as a foliar treatment at 0.28 kg ai/ha in spring. The dip treatment increased the rate at which stalk buds sprouted and usually increased shoot population (tillers) in spring at both a standard planting rate and a rate half that of the standard (two lines and one line of stalks in the planting furrow, respectively). At the standard planting rate, the resulting stalk population and yield of cane and sugar at harvest usually were no higher than the control, probably because of interplant competition. At the reduced planting rate, the ethephon treatment usually produced a higher stalk population and yield at harvest when compared to untreated cane planted at the same rate, but did not consistently produce stalk populations and yields comparable to untreated seed cane planted at the regular rate. Ethephon as a spring foliar treatment on young, actively tillering cane, in either plant or ratoon crops, temporarily slowed growth and did not consistently increase shoot and stalk population at either the standard or reduced planting rates. The results of the study indicate that ethephon has limited potential for increasing sugarcane yield at the standard planting rate but may have application as a dip treatment at a reduced planting rate where the objective is to reduce seed-cane requirements. **(R.W. Millhollon and B.L. Legendre)**

1993 Climatic Conditions

Sugarcane Field Laboratory, Houma, Louisiana

	Temperature, °F		Rainfall, in.		No. rainy days	
Month	Mean	Depart.	Total	Depart.	Total	Depart.
Jan.	55.8	+ 0.9	4.59	+ 0.31	10	+ 2
Feb.	58.5	+ 1.6	3.26	- 1.03	4	- 4
Mar.	59.8	- 2.7	6.11	+ 1.68	8	0
Apr.	62.7	- 5.9	7.65	+ 3.43	8	+ 2
May	72.4	- 2.3	6.07	+ 1.57	8	+ 1
June	80.0	+ 0.1	5.92	- 0.15	12	+ 2
July	82.6	+ 1.4	10.31	+ 2.22	19	+ 4
Aug.	82.8	+ 0.4	6.46	- 0.79	17	+ 3
Sept.	79.1	+ 0.7	4.98	- 1.72	9	- 1
Oct.	69.0	- 0.8	7.47	+ 3.72	10	+ 5
Nov.	58.2	- 2.9	4.16	+ 0.33	8	+ 2
Dec.	53.4	- 1.6	4.38	- 0.54	12	+ 4
Total	814.3	-11.1	71.36	+ 9.03	125	+20

1994 Climatic Conditions

Sugarcane Field Laboratory, Houma, Louisiana

	Temperature, °F		Rainfall, in.		No. rainy days	
Month	Mean	Depart.	Total	Depart.	Total	Depart.
Jan.	50.0	- 4.9	3.23	- 1.05	9	+ 1
Feb.	57.9	+ 1.0	0.95	- 3.34	7	- 1
Mar.	61.1	- 1.4	3.30	- 1.13	5	- 3
Apr.	69.0	+ 0.4	6.68	+ 2.46	8	+ 2
May	74.3	- 0.4	4.85	+ 0.35	9	+ 2
June	79.9	0.0	4.31	- 1.76	13	+ 3
July	80.0	- 1.2	13.99	+ 5.90	19	+ 4
Aug.	80.3	- 2.1	6.71	- 0.54	14	0
Sept.	76.6	- 1.8	3.17	- 3.53	10	0
Oct.	69.5	- 0.3	4.42	+ 0.67	10	+ 5
Nov.	64.2	+ 3.1	2.32	- 1.51	7	+ 1
Dec.	57.0	+ 2.0	5.83	+ 0.91	9	+ 1
Total	819.8	- 5.6	59.76	- 2.57	120	+15

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